REMARKS

Claims 1-15 are all the claims pending in the application. All the claims stand presently rejected under 35 U.S.C. § 112, second paragraph, and under 35 U.S.C. § 103(a) as being unpatentable over Terai (JP 8-32151A) in view of Holcombe et al (US Patent No. 4,261,753). By this Amendment, Applicants amend claims 2, 5, 7, and 9. In addition, Applicants amend the specification.

The Rejection of Claims 1-15 under 35 U.S.C. § 112, second paragraph

The Examiner rejects claims 1-15 under 35 U.S.C. § 112, second paragraph, "as being incomplete for omitting essential structural cooperative relationships of elements and necessary elements, such omission amounting to a gap between the necessary structural connections." Specifically, the Examiner states that "[t]here is no proof that oscillation means (whatever they may be), a box for storing and an optical catalyst serve any function, let alone will produce a laser beam."

Independent claims 1, 2, 4, 5, and 9 recite "laser oscillation means for employing a discharge to excite a laser and to generate a laser beam." In addition, amended independent claim 7 recites "laser oscillation means for employing a discharge by a pair of discharge electrodes that face each other across an intervening discharge space to excite a laser gas and to generate a laser beam."

Exemplary structural details of the claimed "laser oscillation means" are described with reference to Figs. 13 and 14 in the "Description of the Related Art" section on pages 1-4 of the

application text. In addition, page 2 of the "Description of the Related Art" section explains how the exemplary structural details of the claimed "laser oscillation means" employ "a discharge ... to generate a laser beam", as claimed in the various independent claims.

Since exemplary structural details and the manner in which they generate a laser beam are described in the "Description of the Related Art" section (or, in other words, in the background section of the present application), Applicants submit that it is well-known to a person skilled in the art how the claimed "laser oscillation means" functions in order to "generate a laser beam", as recited in the various independent claims. In addition, by reciting "laser oscillation means", Applicants have merely chosen a generic term, as Applicants are permitted to be their own lexicographers.

Referring to the recitation of "a box for storing said laser oscillation means" in independent claims 1, 2, 4, 5, and 9, Applicants note that, throughout the "Description of the Related Art" section and the "Detailed Description of the Preferred Embodiments" section, an exemplary box 13 is mentioned, which, as shown in Figs. 1, 3, 4, 5, 6, 7, 8, 9, 10, and 14, of the application, encompasses the exemplary structural details of the claimed "laser oscillation means." In fact, the phrase "a box for storing said laser oscillation means" itself expressly clarifies that one of the functions of the claimed "box" is "storing said laser oscillation means."

Referring to the recitation of "an optical catalyst layer" in independent claims 1 and 2, Applicants note that, throughout the "Detailed Description of the Preferred Embodiments" section of the present application, an exemplary optical catalyst layer 20 is mentioned whose

functions include absorbing ultraviolet rays, reducing internally produced NOx, and preventing NOx from being discharged to the exterior.[1]

Independent claims 1 and 2 do not recite functions of the claimed "optical catalyst layer", but merely state in structural terms that the optical catalyst layer is "formed on the inner wall of said box" and on "a plate member", respectively. Applicants submit that there is no requirement in the MPEP that Applicants must recite functional limitations in device claims (such as independent claims 1 and 2). In fact, the Examiner himself fails to cite to any such provision in the MPEP. Nor has the Examiner reasoned how or why not reciting functional language in the "optical catalyst layer" limitation must be equated with "an omission of necessary elements", as alleged in the grounds of rejection.

In short, Applicants have merely chosen to claim their invention in broad terms. There is no provision in the MPEP prohibiting such claim drafting.

Finally, Applicants point out that the various structures recited in the claims are clearly interrelated, as required by MPEP § 2172.01. As an example, independent claim 1 recites that the claimed "box" stores the claimed "laser oscillation means", and that the claimed "optical catalyst layer" is formed on the inner wall of the claimed "box".

[1] See specification, e.g., page 14, last paragraph (which bridges over to page 15)

In view of at least the above remarks, Applicants submit that there is no basis for rejecting claims 1-15 under 35 U.S.C. § 112, second paragraph. Therefore, Applicants respectfully request the Examiner to withdraw the § 112 claim rejections.

The Rejection of Claims 1-15 under 35 U.S.C. § 103(a)

Fig. 1 of the present application shows an exemplary embodiment of a laser oscillator, some of the structural details of which are explained in connection with Fig. 14.[2]

Fig. 14 shows a box 13, which is a sealed container filled with laser gas 10. Windows are provided on both sides of the box 13, and doors 14 are attached to close and seal these windows.[3] Main parts inside the box 13 include discharge electrodes 2, gas circulation blower 3, and heat exchanger 6.[4]

In addition, Fig. 1 shows a surface processed layer 20 formed on the inner faces of the box 13 and the doors 14. Therein, the layer 20 is an optical catalyst layer.[5] A surface process is

[2] See specification, page 13, last paragraph (which bridges over to page 14)

[3] See specification, page 3, second full paragraph

[4] See specification, page 3, last paragraph (which bridges over to page 4)

[5] See specification, page 13, last paragraph (which bridges over to page 14)

used to form the optical catalyst layer 20 on the inner faces of the box 13 and the doors 14. As an example, thermal spraying is used for the surface processing.[6]

Independent claim 1 is directed to a laser oscillator, which includes laser oscillation means for employing a discharge to excite a laser and to generate a laser beam; a box for storing said laser oscillation means; and an optical catalyst layer formed on the inner wall of said box.

In rejecting claim 1, the Examiner refers to Fig. 9 of the Terai reference. Fig. 9 of the reference shows a gas laser device having, among other things, a discharging space 4, discharging electrodes 5a and 5b arranged on both sides of the space 4, an external wind tunnel 1 and a catalyst 11. The Examiner equates the external wind tunnel 1 with the "box" and the catalyst 11 with the "optical catalyst layer" recited in claim 1.

However, as evidenced by Figs. 1, 3, 4, and 9 of the Terai reference, there is no teaching or suggestion in the reference that the catalyst 11 is formed on the inner wall of the external wind tunnel 1, contrary to the requirement of claim 1 that the "optical catalyst layer" is "formed on the inner wall of said box." In fact, there is no teaching or suggestion in the Terai reference that <u>any</u> layer is formed on the inner wall of the external wind tunnel 1.

By coating the inside of the laser oscillator with the optical catalyst layer 20, the surface process facilitates the accelerated absorption of ultraviolet rays, and internally produced NOx is

[6] See specification, page 14, first full paragraph

reduced and prevented from being discharged to the exterior.[7] The application text further teaches that, since a surface process is performed, ultraviolet rays are absorbed by the optical catalyst layer 20, and since irradiation of insulators 16, joints 17, and pipes 18 is thereby prevented, the useful lives of these parts are extended.[8]

For at least these reasons, Applicant submits that independent claim 1 is patentable over the prior art made of record.

Fig. 3 of the application shows an exemplary embodiment of the present invention, in which the optical catalyst layer 20 is deposited on the surface of a metal plate 22.[9] Since, as shown in Fig. 3, the metal plate 22 is arranged at the inner side of the box 13 and the doors 14, only this metal plate must be replaced when the effect of the optical catalyst layer 20 deteriorates. Thus, the optical catalyst layer 20 can be replaced relatively easily.[10]

Amended independent claim 2 is directed to a laser oscillator, which includes, among other things, a plate member that is provided at an inner wall of said box and on which an optical catalyst layer is formed.

Applicants note that, as evidenced by Figs. 1, 3, 4, and 9 of the Terai reference, there is no teaching or suggestion in the reference that Terai's catalyst 11 is formed on a plate member

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[7] See specification, page 14, last paragraph (which bridges over to page 15)

[8] See specification, page 17, first full paragraph

[9] See specification, page 17, second full paragraph

[10] See specification, page 17, last paragraph (which bridges over to page 18)

that is provided at an inner wall of the external wind tunnel 1. In fact, there is no teaching or suggestion in the Terai reference that any layer is formed on a plate member that is provided at an inner wall of the external wind tunnel 1.

For at least these reasons, Applicants submit that independent claim 2 is patentable over the prior art made of record.

Independent claim 4 is directed to a laser oscillator, which recites "a graphitized layer formed on the inner wall of said box." As argued above in connection with the patentability of claim 1, the Terai reference fails to teach or suggest that any layer is formed on the inner wall of the wind tunnel 1. Therefore, regardless of whether or not "Holcombe teaches a graphitized material in extremely corrosive environments", as stated in the grounds of rejection, at least the limitation of "a graphitized layer formed on the inner wall of said box" is missing from a combination of the disclosures of the Terai reference and the Holcombe reference.

For at least these reasons, Applicants submit that independent claim 4 is patentable over the prior art made of record.

Amended independent claim 5 is directed to a laser oscillator, which includes, among other things, a plate member that is provided at an inner wall of said box and on which a graphitized layer is formed. As argued above in connection with the patentability of amended claim 2, the Terai reference fails to teach or suggest that any layer is formed on a plate member that is provided at an inner wall of the external wind tunnel 1. Therefore, regardless of whether or not "Holcombe teaches a graphitized material in extremely corrosive environments", as stated

in the grounds of rejection, at least the limitation of "a plate member, provided at an inner wall of said box, on which a graphitized layer is formed" is missing from a combination of the disclosures of the Terai reference and the Holcombe reference.

For at least these reasons, Applicants submit that amended independent claim 5 is patentable over the prior art made of record.

Fig. 6 shows an exemplary embodiment of the present invention, in which, on an inner wall of a door 26 that is attached to the box 13, a recessed portion 26a is formed to condense and reflect light.[11] The inner walls of the box 13 and the surface of the door 26 are recessed so that, when ultraviolet rays produced by a discharge are emitted, the ultraviolet rays are condensed and reflected at a constant curvature at the surface of the recessed portion 26a of the door 26.[12]

Amended independent claim 7 is directed to a laser oscillator, which includes, among other things, laser oscillation means; a box for storing said laser oscillation means; and "a recess portion arranged in said box for receiving ultraviolet rays ... and for reflecting said ultraviolet rays ...."

Referring to the Terai reference, as evidenced by Figs. 1, 3, 4, and 9, there is no teaching or suggestion of any recess portion in the wind tunnel 1.

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[11] See specification, page 24, second full paragraph

[12] See specification, page 24, last paragraph (which bridges over to page 25)

For at least this reason, Applicants submit that amended claim 7 is patentable over the prior art made of record.

Figure 9 of the application shows an exemplary embodiment of the present invention, in which a collector 28 is stored in a container 29.[13] The collector is positioned in an area through which laser gas is circulated so that the hydrogen fluoride in the laser gas can be absorbed.[14]

Amended claim 9 is directed to a laser oscillator, which includes "a laser oscillation means for employing a discharge to excite a laser gas ... " and "a collector for removing hydrogen fluoride from said laser gas."

The Examiner states in the grounds of the rejections that Terai's catalyst 11 can also be considered a collector. However, there is no teaching or suggestion in the Terai reference that the catalyst 11 removes "hydrogen fluoride from said laser gas", as recited in amended claim 9.

For at least this reason, Applicants submit that amended independent claim 9 is patentable over the prior art made of record.

Furthermore, the dependent claims are patentable at least by virtue of dependency from their respective independent claims.

[13] See specification, page 27, first full paragraph

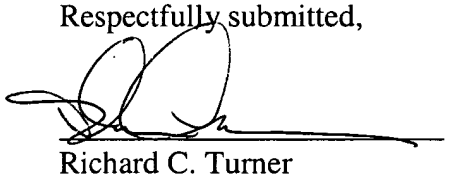
[14] See specification, page 27, last paragraph (which bridges over to page 28)

Finally, Applicants note that the Terai reference discloses that a catalyst regenerates CO_2 by decomposing CO that is generated from CO_2 by discharge. This is fundamentally different from the present invention.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

The specification is changed as follows:

Please change the last paragraph on page 3 (which bridges over to page 4) as follows:

The main parts inside the box 13 are the discharge electrodes 2, the gas circulation blower 3, the partial reflector 4 and the full reflector 5 (not shown), and the heat exchanger 6, which have been explained while referring to Fig. 13. Each of the discharge electrodes 2 includes an electrode tube 15 and an insulator 16, and of these the electrode tube 15 is constituted by a water channel 15a, along which cooling water is supplied to the interior, a metal tube 15b for covering the water path 15a and a dielectric 15c for covering the metal tube 15b. A material such as glass, having a higher permittivity than the insulator 16, is employed as the dielectric 15c. Thus, when a high frequency voltage is applied by the power supply board (not shown in Fig. 14) to the two electrode tubes 15, which are separately arranged at a specific distance from each other, a very smooth and stable discharge can be generated through the dielectric 15c. In order to prevent a discharge from other than the opposed, facing portions of the electrode tubes 15, the opposed, facing faces of the electrode tubes 15 are partially exposed, while the other portions are covered with the insulator 16. In addition, insulating joints 17 and pipes 18 are also provided for cooling the electrode tubes 15. And to cool the laser gas 10,

which passes between the discharge electrodes 2, it is introduced, along a gas duct 25, to the heat exchanger 6.

Please change the first full paragraph on page 14 as follows:

A surface process is used to form the optical catalyst layer 20 on the inner faces of the box 13 and the doors 14. TiO_2 is ~~and~~ an example for the material used for the optical catalyst layer 20. Thermal spraying is an example method that can be used when employing TiO_2 for the surface processing. According to this method, the melted powder material, after being sprayed on a material using a plasma jet device, solidifies and forms a film. Since particles of 10 to 60 μm solidify evenly, a laminated film can be deposited on the surface that effectively prevents the reflection of ultraviolet rays.

Please change the last full paragraph on page 19 as follows:

A laser oscillator according to a third embodiment of the invention will now be described while referring to Fig. 4. In Fig. 4, components denoted by reference numerals 3, 6, 10, 11, 13 to 18 and 25 are identical to or correspond to those in Fig. 1 ~~1~~, and no further explanation for them will be given. Also, in Fig. ~~43~~ 4, according to this embodiment, a surface processed layer 23 formed on the inner walls of a box 13 and doors 14 is a graphitized layer.

Please change the last paragraph on page 20 (which bridges over to page 21) as follows:

Various methods are available for use for graphitizing the surface of metal in accordance with the wavelength of the ultraviolet ray. In this embodiment, since the graphitized metal is to be employed in a special atmosphere for which a laser gas 10 is used in the box 13 of the laser oscillator 1, when graphitization is performed by applying ~~a using~~ a resin or an organic material, or by using an organic dye, the organic material will be decomposed by the ultraviolet rays, and this will accelerate the deterioration of the other parts. Therefore, a method by which an aluminum material is immersed in an acid tank to form an oxide film on its surface is employed to graphitize the metal without using an organic dye. Fig. 12 is a diagram showing the schematic processing used to form an oxide film on the surface of aluminum.

Please change the third paragraph on page 22 as follows:

Since ~~the~~ a container is employed, before the graphitized layer 23 is formed on the inner walls of the box 13 and the doors 14, surface finishing is required so that the joined portions can be adequately sealed by packing, such as an O ring.

Please change the first full paragraph on page 31 as follows:

While chlorine can be absorbed by activated carbon, when it is used, powdered activated carbon dust composed of particles several μm in diameter are produced. When this dust attaches itself to the resonator, the optical parts may be burnt or damaged, and thus, when a process is

performed, the generation of this dust must be prevented. But annealed metal can not be employed for this purpose, since at the most, the smallest opening obtainable with such a filter is 20μm. Therefore, in order to permit the passage of a laser gas and to prevent the generation of the powdered activated carbon dust, a container is formed of fiber membrum or a hollow texture film made of tetrafluoro type Teflon, and the activated carbon is sealed in this container. As a result, since the powdered dust is not dispersed within the box 13 and since the laser gas can pass through the film, the chlorine that is generated can be absorbed and removed from the box ~~134~~ 13, and the useful life of the laser oscillator can be extended.

IN THE CLAIMS:

The claims are amended as follows:

2. (Amended) A laser oscillator comprising:

laser oscillation means for employing a discharge to excite a laser gas and to generate a laser beam;

a box for storing said laser oscillation means; and

a plate member~~,~~ provided ~~inside~~ at an inner wall of said box, at a location where ultraviolet rays generated by said discharge are exposed, and on which an optical catalyst layer is formed.

5. (Amended) A laser oscillator comprising:

laser oscillation means for employing a discharge to excite a laser gas and to generate a laser beam;

a box for storing said laser oscillation means; and

a plate member~~,~~ provided ~~inside~~ at an inner wall of said box, at a location where ultraviolet rays generated by said discharge are exposed, and on which a graphitized layer is formed.

7. (Amended) A laser oscillator comprising:

~~layer~~ laser oscillation means for employing a discharge by a pair of discharge electrodes that face each other across an intervening discharge space to excite a laser gas and to generate a laser beam;

a box for storing said laser oscillation means; and

~~reflection means~~ a recess portion arranged in said box for receiving ultraviolet rays generated by said laser oscillation means, and for reflecting said ultraviolet rays so that the reflected light passes through said discharge space between said pair of discharge electrodes~~; and~~

~~a box for storing said laser oscillation means and said reflection means~~.

9. (Amended) A laser oscillator comprising:

laser oscillation means for employing a discharge to excite a laser gas and to generate a laser beam;

cooling means for cooling said laser gas that is heated by said discharge;

a collector for removing hydrogen fluoride from said laser gas; and

a box for storing said laser oscillation means, said cooling means and said collector,

wherein said collector is located between said cooling means and said laser oscillation means along a path followed by said laser gas while circulating inside said box.